

Biosensor: The Game Changer in Agriculture

Tanushree Saha

Ph.D, Research Scholar, Dept. of Agricultural Extension, B.C.K.V., Mohanpur,
Nadia, W.B.-741252

ARTICLE ID: 100

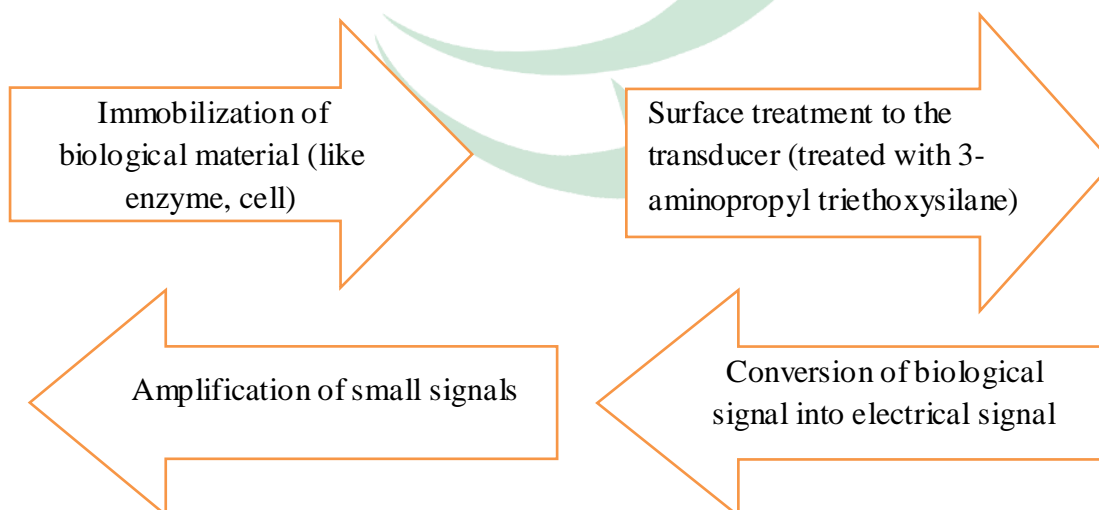
Introduction:

In the year 1950, the first biosensor was developed by American biochemist Leland C Clark. He is also known as father of biosensor. A biosensor is an analytical device which converts biological reaction into digital electrical signals. It can be defined as the analytical device which contains a combination of physical component like transducer and an amplifier and biological component like cell, enzyme etc. and analyte. It is used to control ecological pollution as well as used in agricultural field, food industry etc. In agricultural industry, it can give rapid, non-descriptive and affordable method of the quality monitoring of any product. Biosensor increases the product safety and decrease excess time and cost. It can bring revolution in agricultural industry.

Basic characteristics:

- Biosensor is highly specific for obtaining correct result.
- It is precise and accurate.
- Biosensor is economical and biocompatible.
- Linearity is high for the detection of high substrate concentration.

Working principle of biosensor:



Normally, a preferred biological material is deactivated through some of the traditional methods and the deactivated material is in close to contact with the transducer. The analyte connects to the biological object to make a clear analyte which offers the digital response that can be calculated. In some examples, the analyte is modified to a system that may additionally be linked to discharge of gas, heat, electron ions or hydrogen ions. In this, the transducer can alter the gadget linked converts it into electrical indicator which can be modified and calculated.

Types of agricultural biosensor:

The agricultural biosensors are categorized based on the sensor device and the biological elements. There are different types of agricultural biosensors. This are-

- 1. Electrochemical biosensor:** It is very easy to use device. It measures the degree of electronic current, ionic changes conceded by bio-electrodes. It contains 3 electrodes like a reference electrode, an active electrode and a sink electrode. The object analyte is engaged in the response that occurs on the surface of the active electrode and the ions produced to make a potential which is moved away from the reference electrode to give a signal.
- 2. Whole cell biosensor:** As the name refers, the whole cell is used as a biological component in this type of biosensor. The cells are less sensitive to pH, temperature variation, having inexpensive longer active lifetime.
- 3. Amperometric biosensor:** An amperometric biosensor is a self-contained integrated device. The simple amperometric biosensor uses the 'Clark oxygen' electrode. The principle of the biosensor is based on the amount of the flow of current. The magnitude of the current is proportional to the concentration of the electro active species there in the test solution and both cathodic (reducing) and anodic (oxidizing) reactions can be monitored amperometrically. Most of the amperometric biosensor use enzyme as the biological element.
- 4. Potentiometric biosensor:** This biosensor gives a logarithmic reply with high energetic range. These are based totally on monitoring the potential of a system at a working electrode, with recognize to an accurate reference electrode, under essentially zero current flow situation.

5. Optical biosensor: It is used to detect the amount of light produced or absorbed through the biochemical reactions. This sensor mainly involves antibodies and enzymes like transducing elements.

Application of biosensors in agriculture:

- Detection of maize chlorotic mosaic virus (MCMV).
- Diagnosis of soyabean rust.
- Detection of bacterial phyto-pathogens.
- Control the food quality.
- Determining the level of toxic substance.

Advantages:

- It is easy to use technology.
- It provides accurate reading.
- No need of continuing monitoring.
- It is highly specific
- Response timing is very fast.

Disadvantages:

- The cost of it is very high.
- Heat sterilization is not possible.
- It focuses only on the scientific basis of the technology.
- It is sometime non-reusable.
- Nano-particles may cause serious illness on human body.

Conclusion:

In current generation, biosensor is a game changer in agricultural technology. The easy-to-use device is actually rapid, reliable and accurate analyser of plant disease detection. It is also used in food industry as it helps to control food quality. The biosensor is very advantageous technology, but it has some disadvantages also, like it is high cost, may cause health issue etc. There is need to direct our lookup toward improving the shelf existence of a biosensor for growing the acceptability amongst the end-users. Improvement in primary traits of biosensors will lead to massive utility in important difficult areas in agriculture.



Reference:

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